

42390.P9916

*Patent*

UNITED STATES PATENT APPLICATION

FOR

**Digital Content Distribution**

INVENTORS:

Vaughn Iverson  
Todd Schwartz

Prepared by

Steven D. Yates  
Reg. No. 42,242  
(503) 264-6589

Express Mail mailing label number: EL034437237US

## Digital Content Distribution

### 5 Field of the Invention

The invention generally relates to distribution of digital content, and more particularly to creating, a manifest having structure, meta-data describing digital content, and references to digital resources, where the manifest facilitates finding, obtaining, organizing, collecting, and sharing the digital content.

10

### Background

Computing devices, such as a personal computer, typically employ a folder/document metaphor for storing and organizing content. While such a metaphor is well suited to an office environment, where content is typically in the form of documents,

15 it is not effective when applied to the use and management of arbitrary digital content.

For example, a digital photo album may be defined to correspond to a physical photo album. Thus, certain photos and/or textures may be identified as corresponding to front and back covers for the photo album, and other photos identified as being internal to the album. All content within the album would be stored in a folder or hierarchy of folders.

20 Unfortunately, such a hierarchy lacks cohesion or inherent structure found in a physical photo album. Thus, while a real photo album can be easily organized, shared, etc., there is no standard method for doing so with the hierarchy for the digital photo album.

One solution has been to apply an encapsulating structure (e.g. zip or tar file) to the hierarchy and thus create an archive containing all of the digital content. This 25 archive can then be exchanged, sold, etc. A significant drawback to such an archive is

that it is monolithic, e.g., it contains all data within the album. This reduces the transferability of the album, and restricts selective transfer of only some album contents. In addition, an archive generally lacks data describing the context and contents of the photo album (e.g., meta-data), thus making it difficult to organize and search/find digital content, and to avoid having duplicative digital content. For example, once the archive it received, it needs to be re-created in a folder structure corresponding to the original hierarchy structure, or risk internal references to files being lost. This prevents or restricts moving, organizing, and re-organizing digital content.

In addition, assuming the user can maintain the proper structure of the content, also lacking to such an archive is an easy, robust, and widely-supported method for searching digital content. For example, for music data, without excessive redundancy, folder organization techniques cannot help if you want to locate a song played based on multiple criteria, such as mood and music type, since music would generally fall into multiple categories and thus require entry in multiple folders.

Similarly, one cannot select a video starring a certain actor and start viewing at a particular scene, hum a bar of a tune and have the system find it for you, or find all photos taken at an event last year. These tasks cannot be performed because mere hierarchical storage of digital content lacks associative or context data, such as captions, dates, places, copyrights, artist, author, genre, etc. to allow identification of digital content based on such search criteria.

Assuming the digital content can be located, exchanging the digital content is difficult due to a lack of open and flexible standard to do so. Existing digital content packaging schemes are proprietary and tailored to specific content types, such as for

electronic books or music. Currently there is no technology for uniformly packaging, in electronic form, a wide variety of digital content in a way that qualifies the content as what the entertainment industry calls a “title.”

## 5 Brief Description Of The Drawings

The features and advantages of the present invention will become apparent from the following detailed description of the present invention in which:

FIG. 1 illustrates a generalized network environment according to one embodiment of the invention.

FIG. 2 illustrates one embodiment of a manifest for representing digital content corresponding to a music album.

FIG. 3 illustrates, according to one embodiment of the invention, portions of an XML skeleton for implementing the FIG. 2 manifest.

FIG. 4 is a flowchart illustrating, according to one embodiment of the invention, creating digital content for use by a receiver.

FIG. 5 is a flowchart illustrating, according to one embodiment of the invention, receiving a manifest or manifests from an agent, such as in response to a search query.

FIG. 6 illustrates a suitable computing environment in which certain aspects of the invention may be implemented.

20

## Detailed Description

To address limitations in management and distribution of digital content, a system may be used for uniform electronic packaging of digital content independent of

content type, along with automated distribution of digital content to desired recipients.

The phrase “digital content” refers to digital representations of created works, such as multimedia items including photo albums, music albums, novels, magazines, and the like, as well as entirely new forms of content that may emerge in the electronic realm.

5 The phrase “electronic package” means an instance of digital content that exists in some computer accessible medium, such as on a wire, in computer memory, on a storage device, etc.

The illustrated embodiments of the invention may represent, or package, abstract created works in a concrete electronic digital form, as well as provide an electronic

10 analog to traditional physical goods. For example, a CD-ROM or vinyl album is simply a physical representation of the abstract concept “music album”; a book is simply a physical representation of the abstract concept “novel.” But, it will be appreciated that these exemplary album and novel concepts have been largely defined with respect to the limitations of their physical representations. And, these abstract forms can be faithfully represented in an electronic form. However, it should be appreciated that since a non-physical electronic realm lacks limitations of physical objects, and therefore abstract forms of created works can morph and evolve in ways unpredictable, and perhaps not physically possible.

15 Thus, an electronic package may be structured to correspond to, or mimic, a physical good. For example, an electronic package corresponding to a music compact disc (CD) can be defined as having packaging, cover illustrations, organization, etc., corresponding to a physical CD. However, unlike the physical good, in an electronic realm, the electronic package may also include meta-data describing the parts, and/or

context of the packaged digital content, rules controlling distribution of the digital content, as well as references to content related to but not part of the physical good.

In one embodiment, an electronic package of digital content is represented by a “manifest” (see FIG. 2) that appears as a single unit, or item, to a user/receiver of the 5 manifest. The manifest comprises “component” definitions corresponding to components of the digital content, each component definition specifying a reference to a digital resource.

FIG. 1 illustrates a general computing environment according to one embodiment 10 of the invention. As illustrated, a manifest for an electronic package is created or transmitted by an originator **100-104**, and received by a receiver **106, 108**. It will be appreciated that the terms “receiver” and “originator” are arbitrary, in that one may also 15 perform the operations of the other. Agents **110, 112** facilitate transfer of manifests from originators to receivers. Originators, receivers, and agents are in communication with each other over a network **114** such as an intranet, the Internet, or other network. 20 There may be other networks, not illustrated, providing alternate or direct connections between the agents, originators, and/or receivers.

Agents include, for example, search engines used by a receiver to locate digital content of interest to the receiver, order processing systems for responding to and 20 fulfilling purchase requests, and systems that customize content en route for specific locales. Agents can incorporate arbitrary “intelligence” that facilitate buying, selling, trading, bartering, lending, etc. of digital content. In one embodiment, originators and receivers may also perform the functions of an agent.

Thus, receiver 1 **106** may contact Agent 1 **110**, and indicate interest in obtaining a certain classical music CD as digital content. If Agent 2 cannot directly provide the requested digital content, Agent 1 contacts Agent 2 **112** over the network **114**, and request the desired digital content. Assuming Agent 2 can fulfill the request, Agent 2

5 sends Agent 1 a manifest corresponding to the requested digital content.

It will be appreciated that typical content distribution services, such as Universal Music Group's bluematter and BMG (both online music providers), and Flycode (a peer-to-peer short film distribution network), already allow one to obtain digital content over a network. (Please note that all marks herein are the property of their respective owners.)

10 However, a significant limitation of such services is that received content is a monolithic encapsulation, it contains all parts of the digital content whether one wishes to receive it or not. Thus, for a music album, the receiver would receive all data for all songs within the album, which may potentially include multiple encodings of each song, etc. This

15 contrasts distribution by way of a manifest, which may only contain references to digital resources, allowing advance determination of which parts, if any, of the content to obtain before expending resources to receive it.

Another limitation of prior art techniques is that the content is rigidly structured. For example, bluematter and BMG can provide a "song," or an "album," but these are content forms that cannot be easily extended to include other types of content, such as

20 video clips, discount coupons, etc. Such content is also inflexible in the types of metadata that can be included. For example, fixed file formats (e.g., MP3, WMA, etc.) typically used in such services have specific notions of what constitutes appropriate metadata for a music album or an individual song. This results in limitations in what

data may be represented, and how, thus limiting general applicability of the file format. Such systems are tightly bound with specific encoding formats, and are difficult to upgrade when technological improvements are made.

5 FIG. 2 illustrates one embodiment of a manifest **200** for representing digital content corresponding to an abstract music album. It will be appreciated, however, that a manifest may also be used to electronically represent particular physical implementations of the abstract idea, e.g., to represent compact discs, vinyl albums, etc. It is assumed the manifest is created with an appropriate manifest generation /

10 authoring tool. The manifest binds together various types of resources in their original authored formats. In one embodiment, the manifest only references data that can be created with well known or standard data authoring tools, such as MP3 generators, video editing software, etc.

15 As illustrated, the manifest **200** itself corresponds to a top, or outer, level. Within the illustrated manifest are six item declarations corresponding to two songs **202**, **216**, two videos **230**, **236**, cover art graphics **242** and meta-data **244**. The meta-data **244** may contain distribution rules, requirements, or policies (hereafter “rules or policies”) regarding handling of the manifest, or the digital content described by the manifest.

20 Items (and sub-items) can have sub-items. For example, as illustrated, song 1 **202** contains references **204**, **206** to different encodings of song 1, meta-data **208** describing song 1, a reference **210** to lyrics for song 1, a reference **212** to a musical instrument digital interface (MIDI) encoding of song 1. The references **204**, **206** to the different encodings allow providing different encodings of a song, such as a high bit rate

version and a low bit rate version, allowing a receiver **106, 108** (FIG. 1) to elect a version based on certain criteria. For example, a receiver may elect a version based on communication data rates available to the receiver. The meta-data **208** for song 1 **202** may include song data such as playing time, composer, recording date, copyright information, and the like.

5 The meta-data for song 1 **202** may also contain pricing information for each song encoding, e.g., the high bit rate encoding **206** for song 1 may cost more than the low bit rate **204** encoding. The meta-data may also include other data such as content ratings, intended audience ratings, e.g., an indicator the song is intended for kids, teenagers, adults, etc., song genre, geographic distribution rules, e.g., different geographic regions receive different song versions, parental controls, etc. The manifest primarily contains references to digital resources, rather than directly embedding the resources. The meta-data may be used to determine how to handle digital resources referenced by the manifest (see FIG. 5). The meta-data can also be inspected to prevent duplicative retrieval of digital resources already be present in a cache or local storage, e.g., saved to disk or a collection. Duplicative retrievals unnecessarily burden networks and increase purchase costs and delivery times.

10 The illustrated manifest **200** also includes videos sections **230, 236** having references **232, 238** to video clips of concerts, music videos, or other video data related to the physical good described by the manifest. As with the songs, **202, 216**, the video sections **230, 236** may have associated meta-data **234, 240**, such as title, running time, content ratings, and other such data as discussed above for song data. It will be appreciated that video data is not ordinarily part of a music CD distribution. However,

since the manifest contains references to digital resources, rather than the resources themselves, it is easy to extend the manifest to include varied data typically associated with the music CD, even though such an inclusion would be impractical or cost ineffective to distribute along with the physical CD, or obtain along with a traditional

5 monolithic download.

As illustrated, the manifest may also include a reference **242** to a graphics file, such as for a graphics encoding of the cover art for the music CD. Such graphics data facilitates presenting, by way of a user interface, a visual representation, such a picture of the cover of an album, or other representative view, of the created work being

10 represented by the manifest.

It is assumed that an appropriate user interface, such as a text-based or graphical-based interface is used to identify digital resources to include in the manifest, and to create the manifest accordingly. In one embodiment, the same user interface is used to process received manifests. In one embodiment, the graphical user interface is based on an Internet browser. In one embodiment, the manifest includes security provisions to detect unauthorized tampering with the manifest. In one embodiment, the manifest is cryptographically signed. In another embodiment, some or all of the manifest is encrypted with a private and/or known public cryptographic systems. See, e.g., *Applied Cryptography : Protocols, Algorithms, and Source Code in C* by Bruce

20 Schneier.

FIG. 3 illustrates, according to one embodiment of the invention, portions of an XML skeleton **300** for implementing the FIG. 2 manifest **200**. The eXtensible Markup

Language (XML) is used due to its widespread industry support and structures for organizing data. XML allows creation of custom tags, which enables defining, validating, and interpreting transmitted manifests. It will be appreciated, however, that other languages, such as tag based languages, or scripting languages, may also be used. In addition, in one embodiment, a binary data standard (e.g., cross-platform readable) may be used to encode a manifest. In general, any data format that allows data sets to be named, and hierarchically structured, can be used.

A first tag **302** indicates the beginning of a music package definition, or container, for the digital content defined by the manifest. The package has multiple defined items.

A first item **304** contains information about the "digital item" (in this case, an electronic version of a music album) described by the manifest, and configuration options regarding handling the contents of the package, e.g., how to prompt a receiver regarding processing songs and other digital content referenced by the manifest.

Each defined item, and the manifest itself, may have arbitrary meta-data to allow associating real-world context with an item. Meta-data is introduced with descriptor tags **320, 322** having definitions **324**. A descriptor tag NAME attribute indicates the meta-data attribute being defined, and the VALUE attribute supplies an appropriate value.

The first item **304** includes a choice tag **306** identified with an ID **308** to allow a receiver of the manifest to choose how to receive songs referenced by the manifest. A selection tag **310**, e.g., "pick songs," provides an option for selecting songs individually. It will be appreciated that other selection options, or no options, may be provided.

A subsequent choice tag **312** indicates available songs, e.g., SONG1, SONG2, from which to choose. Note that the choice tag **312** has a condition tag **314** requiring

the above “pick songs” selection tag **310**. This condition must be satisfied before this choice **312** is acted upon, and it operates in the context of the previous choice tag **306**. In such fashion, manifests may be structured to provide choices based on previous selections. Subsequent selection tags **316** define songs that may be individually selected.

5 A following tag **318** indicates a start of a manifest section for selecting a desired bit rate desired for selected songs. As above with song selection, bit rate selection options (not illustrated) may be included to operate with respect to the method employed for song selection. For example, if an election is made to individually pick songs, then one may be prompted for each song to select a desired bit-rate.

10 Other choice tags may also be defined to control delivery of the digital content to another party, e.g., to include an address book to facilitate sale or transfer of digital content to another receiver. Tags may also be defined to prompt a receiver to identify a computing platform receiving the manifest, e.g., desktop computer, portable, hand-held device, personal digital assistant (PDA), as each such device may have different format requirements, storage capacities and interface capabilities.

15 Tags may also be defined to indicate the operating system in use by the receiving device, and to control whether to obtain extra content, such as related videos **230, 236**, cover art and related package graphics, lyrics, press reviews, etc. Tags may 20 also be defined to indicate data format preferences, e.g., graphics images should be converted (if necessary) into Joint Photographic Experts Group (JPEG) format images, or videos should be in a particular format.

Following various choice tags, are descriptor tags **322** that are at the same hierarchical level as the first item **304** definition, e.g., a music compact disc, and therefore define **324** typical characteristics for the disc. Exemplary illustrated characteristics include the type of music disc defined by the item **304** (an album), an 5 audience rating, album title, creator, contributor, album publisher, and album rights (e.g., copyright information). As discussed above, any of these attributes can be used to control or facilitate organization, content filtering, and re-distribution of digital content.

This description assumes the receiver is a person using an application program or device configured to receive and/or process the manifest, and display choices 10 accordingly. However, note that the receiver may be another application program or device, such as one operating to automatically apply local policies or rules to received manifests, before a manifest is received by a person. In particular, there may be local policies, such as parental controls, and these policies may be used to cause a rewriting 15 of the manifest, e.g., per XML rewriting rules, so that the manifest excludes references to undesirable content.

It will be appreciated that the exemplary FIG. 3 skeleton may be constructed with content and features to free a user from tedious download processes, and from the need to know or understand file formats or plug-ins (e.g., application program 20 enhancements designed to process a particular data format) when receiving content from network originators **100-104** (FIG. 1) . Through use of agents **110, 112**, or direct network connections, the user can place an order for digital content, and then continue with other tasks. The order is fulfilled in the background, without user intervention. Delivery can be robust such that if a network connection is broken, a data transfer

continues automatically when the network connection is reestablished. When content has been received, and its manifest accepted, modified or rejected according to user and local-system rules and/or policies, the user can be notified accordingly.

5 FIG. 4 is a flowchart illustrating, according to one embodiment of the invention, creating an electronic package of digital content for use by a receiver. As illustrated, a first operation is to package digital content **400** for distribution to receivers; as discussed above, in one embodiment, a manifest is used to package the content. A packaging program is used to identify content to be packaged and generate a corresponding manifest. Individual digital resources can be identified by way of traditional file selection dialogs, or with Object Linking and Embedding (OLE) type drag and drop operations, or through other selection techniques.

10

When created, the manifest contains references to identified resources, and if desired, a virtual structure corresponding to a physical good, e.g., a music CD. Thus, a receiving program for a music CD manifest would present a user interface displaying the virtual representation of the physical good. In the CD example, this might include rendering a CD jewel box with appropriate cover art and song listings as defined within the manifest.

15

A created manifest is sent **402** to an agent for distribution, which in turn stores **20** **404** the manifest in a public storage. Note that the storage need not be publicly accessible, however public access is assumed so that search engines, agents, and other location applications are able to mine and/or index stored manifests. It is assumed that the agent stores the manifest in a database. The digital resources

identified by the manifest are stored **406** as well. The digital resources may be stored in public or private storage locations depending on intellectual property rights for the digital resources.

Once the manifest has been created and stored, an agent can receive **408** a

5 search query, e.g., purchase request, database look-up request, etc. The agent searches **410** through the database for manifests corresponding to the query.

Assuming manifests are XML based, it will be appreciated that different query languages may be used depending on manifest formatting and database technology used to store the manifests. For example, the agent may use XML Query Language (XQL) queries, Stanford University's Lore query language, or other query languages.

Manifests matching the received **408** query are returned **412** to a requestor. This may result in a request to purchase digital content identified by a manifest. Towards this end, the agent would confirm payment for digital content as required by a manifest, and make digital content available to a purchaser. Various known techniques may be employed to provide purchased digital content in a secure fashion so as to reduce possibility of illicit appropriation of the digital content, e.g., temporary names and locations for the digital resources included in the content, creation of secure communications channels or tunnels between the agent and purchases, or the like.

20 FIG. 5 is a flowchart illustrating, according to one embodiment of the invention, receiving **500** a manifest or manifests from an agent, such as in response to a search query. It is assumed the manifest is received by an application program, operating system extension, or the like, before a user / person is granted access to the manifest

or allowed to take action on (e.g., purchase) the digital content referenced by the manifest.

When the manifest is received, a receiver **106, 108** (FIG. 1) applies **502, 506** rules or policies to the meta-data **208, 222, 234, 240, 244** (FIG. 2) to determine how to process the digital content, such as whether to reject some or all of the manifest. For example, a receiver may have local rules controlling whether to include supplemental content such as the videos **230, 236**, (FIG. 2) MIDI encodings **212, 226** (FIG. 2), or other data not traditionally part of an original physical good, e.g., the music CD. A user preference may be set to cause discarding of any such supplemental manifest portions.

In one embodiment, there may be different rules or policies **506** for each user of the receiving device, e.g., the receiving device may be a multiple-user computer, in addition to global rules or policies that are applied **502** to all users of the computing device. For example, parental controls may be used to globally restrict the type of content that any user may receive, or content known to be incompatible with the receiver may be automatically edited out of a manifest. In one embodiment, a received manifest is rewritten **504**, if necessary, to comply with the global rules or policies. Note that a remote management system can be used to set or change rules or policies.

After checking the manifest against global rules or policies, user rules or policies are then applied **506** to the manifest, and the manifest again rewritten **508**, if necessary, to comply with the user rules or policies. In one embodiment, the process of “rewriting” a manifest is done in a rigorous manner. The rules controlling the rewriting are expressed in declarative form within the manifest itself within `<choice>` and `<selection>` tags, and their corresponding `<condition>` tags. This makes the rewriting process

robust, and ensures the resulting rewritten manifest is valid. Once a received manifest has cleared both global and user rules or policies, the resultant manifest is executed or interpreted **510** by the receiver. As discussed above with respect to FIG. 3, such processing may cause a user interface to be displayed to allow a user selection among 5 different choices provided by the manifest for buying or obtaining **512** digital content accordingly.

In one embodiment, manifests are encoded according to a rules based grammar comprising the following exemplary rules:

10	(1)	container	::= container* item* meta-data
	(2)	item	::= (item   component)+ choice* meta-data* condition*
15	(3)	component	::= resource meta-data* anchor* condition*
	(4)	meta-data	::= meta-data* (component   statement) condition*
	(5)	anchor	::= reference meta-data* condition*
	(6)	choice	::= selection+ meta-data* condition*
	(7)	selection	::= predicate meta-data* condition*
	(8)	condition	::= predicate+

Where: a container may be a hierarchical structure allowing items to be grouped to form logical packages that may be transported, exchanged, sold, stored, etc. An item is a grouping of sub-items and/or components associated with relevant meta-data about 20 the item. Items may contain choices for customizing and/or configuring the item, and may be conditioned on predicates asserted by selections defined in the choices. A resource is a collection of data, such as an audio clip, image file, text document, or other data. A component is an association between a resource and all of its relevant meta-data; component meta-data will typically contain control or structural information 25 about a resource, e.g., bit rate, media type, character set, encryption information, etc. A reference designates a portion of a resource, such as a specific location or range within the resource. A “statement” comprises a value and an associated domain for that

value. And, a predicate is a non-substitutable token, and in one embodiment, has a true, false, or undecided value.

FIG. 6 and the following discussion are intended to provide a brief, general  
5 description of a suitable computing environment in which certain aspects of the  
illustrated invention may be implemented.

An exemplary system for implementing the invention includes a computing device **600** having system bus **602** for coupling various computing device components.

Typically, attached to the bus are non-programmable and programmable processors  
10 **604**, a memory **606** (e.g., RAM, ROM), storage devices **608**, a video interface **610**, and  
input/output interface ports **612**. Storage devices include hard-drives, floppy-disks,  
optical storage, magnetic cassettes, tapes, flash memory cards, memory sticks, digital  
video disks, and the like.

The invention may be described by reference to different high-level program  
15 modules and/or low-level hardware contexts. Those skilled in the art will realize that  
program modules can be interchanged with low-level hardware instructions. Program  
modules include procedures, functions, programs, components, data structures, and the  
like, for performing particular tasks or implementing particular abstract data types.

Modules may be incorporated into single and multi-processor computing devices,  
20 Personal Digital Assistants (PDAs), cellular telephones, and the like. Thus, the storage  
systems and associated media can store data and executable instructions for the  
computing device.

10  
15  
20  
25  
30  
35  
40  
45  
50  
55  
60  
65  
70  
75  
80  
85  
90  
95

As discussed above with respect to FIG. 1, the computing device is expected to operate in a networked environment using logical connections to one or more remote computing devices **614**, **616** through a network interface **618**, modem **620**, or other communication pathway. Computing devices may be interconnected by way of a network **622** such as an intranet, the Internet, or other network. Modules may be implemented in a single computing device, or processed in a distributed network environment, and stored in both local and remote memory. Thus, for example, with respect to the illustrated embodiments, assuming computing device **600** is a computing device operated by a user searching for music in a particular genre, then remote devices **614**, **616** may respectively be first and second agents that receive and respond to search issued by computing device **600**.

It will be appreciated that remote computing devices **614**, **616** may be configured like computing device **600**, and therefore include many or all of the elements discussed for computing device. It should also be appreciated that computing devices **600**, **614**, **616** may be embodied in a single device, or separate communicatively-coupled components, and may include or be embodied in routers, bridges, peer devices, web servers, and application programs utilizing network application protocols such as the HyperText Transfer Protocol (HTTP), File Transfer Protocol (FTP), and the like.

Having described and illustrated the principles of the invention with reference to illustrated embodiments, it will be recognized that the illustrated embodiments can be modified in arrangement and detail without departing from such principles.

And, even though the foregoing discussion has focused on particular embodiments, it is understood that other configurations are contemplated. In particular,

even though expressions such as "in one embodiment," "in another embodiment," or the like are used herein, these phrases are meant to generally reference embodiment possibilities, and are not intended to limit the invention to particular embodiment configurations. As used herein, these terms may reference the same or different 5 embodiments, and unless implicitly or expressly indicated otherwise, embodiments are combinable into other embodiments. Consequently, in view of the wide variety of permutations to the above-described embodiments, the detailed description is intended to be illustrative only, and should not be taken as limiting the scope of the invention.

What is claimed as the invention, therefore, is all such modifications as may 10 come in the scope and spirit of the following claims and equivalents thereto.

10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100  
101  
102  
103  
104  
105  
106  
107  
108  
109  
110  
111  
112  
113  
114  
115  
116  
117  
118  
119  
120  
121  
122  
123  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133  
134  
135  
136  
137  
138  
139  
140  
141  
142  
143  
144  
145  
146  
147  
148  
149  
150  
151  
152  
153  
154  
155  
156  
157  
158  
159  
160  
161  
162  
163  
164  
165  
166  
167  
168  
169  
170  
171  
172  
173  
174  
175  
176  
177  
178  
179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
269  
270  
271  
272  
273  
274  
275  
276  
277  
278  
279  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
339  
340  
341  
342  
343  
344  
345  
346  
347  
348  
349  
349  
350  
351  
352  
353  
354  
355  
356  
357  
358  
359  
359  
360  
361  
362  
363  
364  
365  
366  
367  
368  
369  
369  
370  
371  
372  
373  
374  
375  
376  
377  
378  
379  
379  
380  
381  
382  
383  
384  
385  
386  
387  
388  
389  
389  
390  
391  
392  
393  
394  
395  
396  
397  
398  
399  
399  
400  
401  
402  
403  
404  
405  
406  
407  
408  
409  
409  
410  
411  
412  
413  
414  
415  
416  
417  
418  
419  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428  
429  
429  
430  
431  
432  
433  
434  
435  
436  
437  
438  
439  
439  
440  
441  
442  
443  
444  
445  
446  
447  
448  
449  
449  
450  
451  
452  
453  
454  
455  
456  
457  
458  
459  
459  
460  
461  
462  
463  
464  
465  
466  
467  
468  
469  
469  
470  
471  
472  
473  
474  
475  
476  
477  
478  
479  
479  
480  
481  
482  
483  
484  
485  
486  
487  
488  
489  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538  
539  
539  
540  
541  
542  
543  
544  
545  
546  
547  
548  
549  
549  
550  
551  
552  
553  
554  
555  
556  
557  
558  
559  
559  
560  
561  
562  
563  
564  
565  
566  
567  
568  
569  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
589  
590  
591  
592  
593  
594  
595  
596  
597  
598  
598  
599  
599  
600  
601  
602  
603  
604  
605  
606  
607  
608  
609  
609  
610  
611  
612  
613  
614  
615  
616  
617  
618  
619  
619  
620  
621  
622  
623  
624  
625  
626  
627  
628  
629  
629  
630  
631  
632  
633  
634  
635  
636  
637  
638  
639  
639  
640  
641  
642  
643  
644  
645  
646  
647  
648  
649  
649  
650  
651  
652  
653  
654  
655  
656  
657  
658  
659  
659  
660  
661  
662  
663  
664  
665  
666  
667  
668  
669  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688  
689  
689  
690  
691  
692  
693  
694  
695  
696  
697  
697  
698  
699  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
709  
710  
711  
712  
713  
714  
715  
716  
717  
718  
719  
719  
720  
721  
722  
723  
724  
725  
726  
727  
728  
729  
729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
739  
740  
741  
742  
743  
744  
745  
746  
747  
748  
749  
749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768  
769  
769  
770  
771  
772  
773  
774  
775  
776  
777  
778  
779  
779  
780  
781  
782  
783  
784  
785  
786  
787  
788  
789  
789  
790  
791  
792  
793  
794  
795  
796  
797  
797  
798  
799  
799  
800  
801  
802  
803  
804  
805  
806  
807  
808  
809  
809  
810  
811  
812  
813  
814  
815  
816  
817  
818  
819  
819  
820  
821  
822  
823  
824  
825  
826  
827  
828  
829  
829  
830  
831  
832  
833  
834  
835  
836  
837  
838  
839  
839  
840  
841  
842  
843  
844  
845  
846  
847  
848  
849  
849  
850  
851  
852  
853  
854  
855  
856  
857  
858  
859  
859  
860  
861  
862  
863  
864  
865  
866  
867  
868  
869  
869  
870  
871  
872  
873  
874  
875  
876  
877  
878  
879  
879  
880  
881  
882  
883  
884  
885  
886  
887  
888  
889  
889  
890  
891  
892  
893  
894  
895  
896  
897  
897  
898  
899  
899  
900  
901  
902  
903  
904  
905  
906  
907  
908  
909  
909  
910  
911  
912  
913  
914  
915  
916  
917  
918  
919  
919  
920  
921  
922  
923  
924  
925  
926  
927  
928  
929  
929  
930  
931  
932  
933  
934  
935  
936  
937  
938  
939  
939  
940  
941  
942  
943  
944  
945  
946  
947  
948  
949  
949  
950  
951  
952  
953  
954  
955  
956  
957  
958  
959  
959  
960  
961  
962  
963  
964  
965  
966  
967  
968  
969  
969  
970  
971  
972  
973  
974  
975  
976  
977  
978  
979  
979  
980  
981  
982  
983  
984  
985  
986  
987  
988  
988  
989  
989  
990  
991  
992  
993  
994  
995  
996  
997  
997  
998  
999  
999  
1000  
1001  
1002  
1003  
1004  
1005  
1006  
1007  
1008  
1009  
1009  
1010  
1011  
1012  
1013  
1014  
1015  
1016  
1017  
1018  
1019  
1019  
1020  
1021  
1022  
1023  
1024  
1025  
1026  
1027  
1028  
1029  
1029  
1030  
1031  
1032  
1033  
1034  
1035  
1036  
1037  
1038  
1039  
1039  
1040  
1041  
1042  
1043  
1044  
1045  
1046  
1047  
1048  
1049  
1049  
1050  
1051  
1052  
1053  
1054  
1055  
1056  
1057  
1058  
1059  
1059  
1060  
1061  
1062  
1063  
1064  
1065  
1066  
1067  
1068  
1069  
1069  
1070  
1071  
1072  
1073  
1074  
1075  
1076  
1077  
1078  
1079  
1079  
1080  
1081  
1082  
1083  
1084  
1085  
1086  
1087  
1088  
1088  
1089  
1089  
1090  
1091  
1092  
1093  
1094  
1095  
1096  
1097  
1097  
1098  
1099  
1099  
1100  
1101  
1102  
1103  
1104  
1105  
1106  
1107  
1108  
1109  
1109  
1110  
1111  
1112  
1113  
1114  
1115  
1116  
1117  
1118  
1119  
1119  
1120  
1121  
1122  
1123  
1124  
1125  
1126  
1127  
1128  
1129  
1129  
1130  
1131  
1132  
1133  
1134  
1135  
1136  
1137  
1138  
1139  
1139  
1140  
1141  
1142  
1143  
1144  
1145  
1146  
1147  
1148  
1149  
1149  
1150  
1151  
1152  
1153  
1154  
1155  
1156  
1157  
1158  
1159  
1159  
1160  
1161  
1162  
1163  
1164  
1165  
1166  
1167  
1168  
1169  
1169  
1170  
1171  
1172  
1173  
1174  
1175  
1176  
1177  
1178  
1179  
1179  
1180  
1181  
1182  
1183  
1184  
1185  
1186  
1187  
1188  
1188  
1189  
1189  
1190  
1191  
1192  
1193  
1194  
1195  
1196  
1197  
1197  
1198  
1199  
1199  
1200  
1201  
1202  
1203  
1204  
1205  
1206  
1207  
1208  
1209  
1209  
1210  
1211  
1212  
1213  
1214  
1215  
1216  
1217  
1218  
1219  
1219  
1220  
1221  
1222  
1223  
1224  
1225  
1226  
1227  
1228  
1229  
1229  
1230  
1231  
1232  
1233  
1234  
1235  
1236  
1237  
1238  
1239  
1239  
1240  
1241  
1242  
1243  
1244  
1245  
1246  
1247  
1248  
1249  
1249  
1250  
1251  
1252  
1253  
1254  
1255  
1256  
1257  
1258  
1259  
1259  
1260  
1261  
1262  
1263  
1264  
1265  
1266  
1267  
1268  
1269  
1269  
1270  
1271  
1272  
1273  
1274  
1275  
1276  
1277  
1278  
1279  
1279  
1280  
1281  
1282  
1283  
1284  
1285  
1286  
1287  
1288  
1288  
1289  
1289  
1290  
1291  
1292  
1293  
1294  
1295  
1296  
1297  
1297  
1298  
1299  
1299  
1300  
1301  
1302  
1303  
1304  
1305  
1306  
1307  
1308  
1309  
1309  
1310  
1311  
1312  
1313  
1314  
1315  
1316  
1317  
1318  
1319  
1319  
1320  
1321  
1322  
1323  
1324  
1325  
1326  
1327  
1328  
1329  
1329  
1330  
1331  
1332  
1333  
1334  
1335  
1336  
1337  
1338  
1339  
1339  
1340  
1341  
1342  
1343  
1344  
1345  
1346  
1347  
1348  
1349  
1349  
1350  
1351  
1352  
1353  
1354  
1355  
1356  
1357  
1358  
1359  
1359  
1360  
1361  
1362  
1363  
1364  
1365  
1366  
1367  
1368  
1369  
1369  
1370  
1371  
1372  
1373  
1374  
1375  
1376  
1377  
1378  
1379  
1379  
1380  
1381  
1382  
1383  
1384  
1385  
1386  
1387  
1388  
1388  
1389  
1389  
1390  
1391  
1392  
1393  
1394  
1395  
1396  
1397  
1397  
1398  
1399  
1399  
1400  
1401  
1402  
1403  
1404  
1405  
1406  
1407  
1408  
1409  
1409  
1410  
1411  
1412  
1413  
1414  
1415  
1416  
1417  
1418  
1419  
1419  
1420  
1421  
1422  
1423  
1424  
1425  
1426  
1427  
1428  
1429  
1429  
1430  
1431  
1432  
1433  
1434  
1435  
1436  
1437  
1438  
1439  
1439  
1440  
1441  
1442  
1443  
1444  
1445  
1446  
1447  
1448  
1449  
1449  
1450  
1451  
1452  
1453  
1454  
1455  
1456  
1457  
1458  
1459  
1459  
1460  
1461  
1462  
1463  
1464  
1465  
1466  
1467  
1468  
1469  
1469  
1470  
1471  
1472  
1473  
1474  
1475  
1476  
1477  
1478  
1479  
1479  
1480  
1481  
1482  
1483  
1484  
1485  
1486  
1487  
1488  
1488  
1489  
1489  
1490  
1491  
1492  
1493  
1494  
1495  
1496  
1497  
1497  
1498  
1499  
1499  
1500  
1501  
1502  
1503  
1504  
1505  
1506  
1507  
1508  
1509  
1509  
1510  
1511  
1512  
1513  
1514  
1515  
1516  
1517  
1518  
1519  
1519  
1520  
1521  
1522  
1523  
1524  
1525  
1526  
1527  
1528  
1529  
1529  
1530  
1531  
1532  
1533  
1534  
1535  
1536  
1537  
1538  
1539  
1539  
1540  
1541  
1542  
1543  
1544  
1545  
1546  
1547  
1548  
1549  
1549  
1550  
1551  
1552  
1553  
1554  
1555  
1556  
1557  
1558  
1559  
1559  
1560  
1561  
1562  
1563  
1564  
1565  
1566  
1567  
1568  
1569  
1569  
1570  
1571  
1572  
1573  
1574  
1575  
1576  
1577  
1578  
1579  
1579  
1580  
1581  
1582  
1583  
1584  
1585  
1586  
1587  
1588  
1588  
1589  
1589  
1590  
1591  
1592  
1593  
1594  
1595  
1596  
1597  
1597  
1598  
1599  
1599  
1600  
1601  
1602  
1603  
1604  
1605  
1606  
1607  
1608  
1609  
1609  
1610  
1611  
1612  
1613  
1614  
1615  
1616  
1617  
1618  
1619  
1619  
1620  
1621  
1622  
1623  
1624  
1625  
1626  
1627  
1628  
1629  
1629  
1630  
1631  
1632  
1633  
1634  
1635  
1636  
1637  
1638  
1639  
1639  
1640  
1641  
1642  
1643  
1644  
1645  
1646  
1647  
1648  
1649  
1649  
1650  
1651  
1652  
1653  
1654  
1655  
1656  
1657  
1658  
1659  
1659  
1660  
1661  
1662  
1663  
1664  
1665  
1666  
1667  
1668  
1669  
1669  
1670  
1671  
1672  
1673  
1674  
1675  
1676  
1677  
1678  
1679  
1679  
1680  
1681  
1682  
1683  
1684  
1685  
1686  
1687  
1688  
1688  
1689  
1689  
1690  
1691  
1692  
1693  
1694  
1695  
1696  
1697  
1697  
1698  
1699  
1699  
1700  
1701  
1702  
1703  
1704  
1705  
1706  
1707  
1708  
1709  
1709  
1710  
1711  
1712  
1713  
1714  
1715  
1716  
1717  
1718  
1719  
1719  
1720  
1721  
1722  
1723  
1724  
1725  
1726  
1727  
1728  
1729  
1729  
1730  
1731  
1732  
1733  
1734  
1735  
1736  
1737  
1738  
1739  
1739  
1740  
1741  
1742  
1743  
1744  
1745  
1746  
1747  
1748  
1749  
1749  
1750  
1751  
1752  
1753  
1754  
1755  
1756  
1757  
1758  
1759  
1759  
1760  
1761  
1762  
1763  
1764  
1765  
1766  
1767  
1768  
1769  
1769  
1770  
1771  
1772  
1773  
1774  
1775  
1776  
1777  
1778  
1779  
1779  
1780  
1781  
1782  
1783  
1784  
1785  
1786  
1787  
1788  
1788  
1789  
1789  
1790  
1791  
1792  
1793  
1794  
1795  
1796  
1797  
1797  
1798  
1799  
1799  
1800  
1801  
1802  
1803  
1804  
1805  
1806  
1807  
1808  
1809  
1809  
1810  
1811  
1812  
1813  
1814  
1815  
1816  
1817  
1818  
1819  
1819  
1820  
1821  
1822  
1823  
1824  
1825  
1826  
1827  
1828  
1829  
1829  
1830  
1831  
1832  
1833  
1834  
1835  
1836  
1837  
1838  
1839  
1839  
1840  
1841  
1842  
1843  
1844  
1845  
1846  
1847  
1848  
1849  
1849  
1850  
1851  
1852  
1853  
1854  
1855  
1856  
1857  
1858  
1859  
1859  
1860  
1861  
1862  
1863  
1864  
1865  
1866  
1867  
1868  
1869  
1869  
1870  
1871  
1872  
1873  
1874  
1875  
1